

CLAIMS:

1. An electrophoretic display panel for displaying a picture and subsequently displaying a subsequent picture comprising
- a pixel having
 - an electrophoretic medium comprising first and second charged particles, the
- 5 first charged particles having a first optical property, the second charged particles having a second optical property different from the first optical property, the first and the second charged particles being able to occupy positions in a common region of the pixel,
- an optical state depending on the positions of the particles in the common region, and
- 10 - transition control means being able to control a transition of at least a first number of the first particles and at least a second number of the second particles being in separate regions in the common region for displaying the picture to separate regions in the common region for displaying the subsequent picture, characterized in that,
- 15 the transition control means are further able to control the first number of the first particles and the second number of the second particles to be in separate regions in the common region during the transition.
2. A display panel as claimed in claim 1 characterized in that
- 20 - the transition control means are able to control the transition of the first and the second particles being in substantially separate regions in the common region for displaying the picture to substantially separate regions in the common region for displaying the subsequent picture, and
- the transition control means are further able to control the first and the second
- 25 particles to be in substantially separate regions in the common region during the transition.
3. A display panel as claimed in claim 2 characterized in that
- the common region comprises at least three substantially separate regions, at least one of which is unoccupied,

- the transition control means comprise:
 - electrodes for receiving potentials, each one of the electrodes being associated with a substantially separate region, and
 - drive means being able to control the potentials to control the transition of
 - 5 the first and the second particles being in separate ones of the substantially separate regions for displaying the picture to separate ones of the substantially separate regions for displaying the subsequent picture, and
 - the transition comprises a sub-transition wherein a member of a list having as members a collection of the first particles and a collection of the second particles is brought
 - 10 from the member's substantially separate region to one of the substantially empty separate regions.
4. A display panel as claimed in claim 3 characterized in that
- a first one of the substantially separate regions provides a first reservoir for the
 - 15 first particles substantially non-contributing to the optical state of the pixel, and
 - a second one of the substantially separate regions provides a second reservoir for the second particles substantially non-contributing to the optical state of the pixel,
 - a third one of the substantially separate regions substantially contributes to the optical state of the pixel, and
 - 20 - the transition comprises:
 - a first sub-transition wherein the member being in the third one of the substantially separate regions for displaying the picture is brought to the member's reservoir, and subsequently
 - a second sub-transition wherein one of the members is brought from the
 - 25 member's reservoir to the third one of the substantially separate regions for displaying the subsequent picture.
5. A display panel as claimed in claim 3 characterized in that
- a first one of the substantially separate regions provides a first reservoir for the
 - 30 first particles substantially non-contributing to the optical state of the pixel, and
 - a second one of the substantially separate regions provides a second reservoir for the second particles substantially non-contributing to the optical state of the pixel,
 - a third one and a fourth one of the substantially separate regions each substantially contribute to the optical state of the pixel, and

- the transition comprises:

- a first sub-transition wherein the members being in the third one and the fourth one of the substantially separate regions for displaying the picture are brought to their respective reservoirs, and subsequently

5 - a second sub-transition wherein the members are brought from their respective reservoirs to the third one and the fourth one of the substantially separate regions for displaying the subsequent picture.

6. A display panel as claimed in claim 3 characterized in that

10 - a first one of the substantially separate regions provides a first reservoir for the first particles substantially non-contributing to the optical state of the pixel, and

- a second one of the substantially separate regions provides a second reservoir for the second particles substantially non-contributing to the optical state of the pixel;

- a third one and a fourth one of the substantially separate regions each
15 substantially contribute to the optical state of the pixel, and

- the transition comprises:

- a first sub-transition wherein the members being in the third one and the fourth one of the substantially separate regions for displaying the picture that will be absent in the third one and the fourth one of the substantially separate regions for displaying the
20 subsequent picture are brought to their respective reservoirs, and subsequently

- a second sub-transition wherein the members which are absent in the third one and the fourth one of the substantially separate regions for displaying the picture that have to be present in the third one and the fourth one of the substantially separate regions for displaying the subsequent picture are brought from their respective reservoirs to the third one
25 and/or the fourth one of the substantially separate regions for displaying the subsequent picture.

7. A display panel as claimed in claim 3 characterized in that

- the pixel has a viewing surface for being viewed by a viewer;

30 - the electrodes have substantially flat surfaces facing the particles, and

- the surfaces are substantially parallel to the viewing surface.

8. A display panel as claimed in claim 7 characterized in that the surfaces of the electrodes are present in a substantially flat plane.

9. A display panel as claimed in claim 3 characterized in that
- the pixel has a viewing surface for being viewed by a viewer,
 - the electrodes have substantially flat surfaces facing the particles,
 - 5 - the surfaces of the electrodes being associated with substantially separate regions that are substantially contributing to the optical state of the pixel are substantially parallel to the viewing surface, and
 - the surfaces of the electrodes being associated with substantially separate regions that are substantially non-contributing to the optical state of the pixel are
 - 10 substantially perpendicular to the viewing surface.
10. A display panel as claimed in claim 3 characterized in that
- a first one of the substantially separate regions provides a first reservoir for the first particles,
 - 15 - a second one of the substantially separate regions provides a second reservoir for the second particles, and
 - the display panel further comprises first decoupling means to reduce the influence of the potential of the electrode associated with the first reservoir on the position of the second particles.
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11. A display panel as claimed in claim 10 characterized in that the display panel further comprises second decoupling means to reduce the influence of the potential of the electrode associated with the second reservoir on the position of the first particles.
- 25 12. A display panel as claimed in claim 11 characterized in that the first and the second decoupling means are realised by the electrophoretic medium comprising a hysteresis effect.
13. A display panel as claimed in claim 11 characterized in that the first and the
- 30 second decoupling means comprise a first and a second gate electrode for receiving a first and a second gate potential, the first and the second gate electrode being present between the electrodes associated with the first and the second reservoir.

14. A display panel as claimed in claim 13 characterized in that the first gate electrode is present between the electrode associated with the first reservoir and the electrode associated with a third one of the substantially separate regions and the second gate electrode is present between the electrode associated with the second reservoir and the electrode associated with the third one of the substantially separate regions.

15. A display panel as claimed in claim 14 characterized in that , in operation, the potentials of the electrodes associated with the first and the second reservoir and the potential of the electrode associated with the third one of the substantially separate regions are substantially constant in time.

16. A display panel as claimed in claim 11 characterized in that the first and the second decoupling means comprise a first particles repulsive layer present between the electrode associated with the first reservoir and the electrode associated with a third one of the substantially separate regions, and a second particles repulsive layer present between the electrode associated with the second reservoir and the electrode associated with the third one of the substantially separate regions.

17. A display panel as claimed in claim 11 characterized in that the first and the second decoupling means comprise a first membrane through which a passage of the first particles is determined by a first threshold, the first membrane being present between the electrode associated with the first reservoir and the electrode associated with a third one of the substantially separate regions, and a second membrane through which a passage of the second particles is determined by a second threshold, the second membrane being present between the electrode associated with the second reservoir and the electrode associated with the third one of the substantially separate regions.

18. A display device comprising the display panel as claimed in claim 2 and a circuitry to provide image information to the display panel.

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19. Method of driving an electrophoretic display panel for displaying a picture and subsequently displaying a subsequent picture, the electrophoretic display panel comprising
- a pixel having

- an electrophoretic medium comprising first and second charged particles, the first charged particles having a first optical property, the second charged particles having a second optical property different from the first optical property, the first and the second charged particles being able to occupy positions in a common region of the pixel,
 - 5 - an optical state depending on the positions of the particles in the common region,
 - the method comprising controlling a transition of at least a first number of the first particles and at least a second number of the second particles from separate regions in the common region for displaying the picture via separate regions in the common region to
 - 10 separate regions in the common region for displaying the subsequent picture.
20. Method of driving an electrophoretic display panel as claimed in claim 19 characterized in that the method comprises controlling the transition of the first and the second particles from substantially separate regions in the common region for displaying the
- 15 picture via substantially separate regions in the common region to substantially separate regions in the common region for displaying the subsequent picture.